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VOLVOX FOR LABORATORY USE

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In providing a supply of Volvox for class use late in the fall, difficulty has been experienced in two respects: in keeping the material alive in the laboratory as long as desired, and in getting specimens containing sperm and ova. Inquiry reveals the fact that others have had the same trouble. I have recently been able to overcome both these difficulties, and at the suggestion of Dr. H. H. Newman have recorded the method in some brief notes.

Species.—So far as known, the only species of Volvox that has been found in the vicinity of Ann Arbor during the late autumn is *Volvox aureus* Ehrenb. It is not very abundant, and I have never found it in the sexual stage at the time it was collected. It occurs in small glacial pools containing Riccia and duckweed.

During the early spring *Volvox globator* Linn., and no other species, occurs in great abundance in the same pools that later contain *Volvox aureus.* I have occasionally found it in the sexual stage when collected.

By the latter part of June *Volvox globator* has become quite scarce, and *V. aureus* has begun to appear. During the early part of July the two species exist in the same habitats, but neither is very abundant.

Since Volvox is so widely used for laboratory work by beginning classes, the marked specific differences are matters of importance. *Volvox globator* is the form described in text-books, but the description is far from being applicable to *V. aureus.* Since the latter may at times be the only species available, it may be profitable to call attention to the differences between the two species, for it is to be suspected that *Volvox aureus* is sometimes used without its species being recognized.

Volvox globator is considerably larger than *V. aureus*; its somatic cells are more numerous and compactly arranged. The somatic cells of *globator* are angular and connected by very stout protoplasmic strands; the somatic cells of *aureus* are round when seen from the surface, and connected by very slender protoplasmic strands, difficult for students to make out under the microscope. *Volvox globator* is monœcious: in the sexual stage both sperm bundles and eggs may be found in the same colony at the same time. The number of sperm bundles in a single colony is small. *Volvox aureus* is either diœcious or monœcious proterogynous: sperm and eggs are never found together in a single colony at the same time, but the colony may contain one or the other exclusively. However, I have found daughter colonies, some of which contained bundles of sperms, others ova, within the same parent colony. The number of sperm bundles in a single colony is very large. *Sphærosira volvox* Ehrenb. is an old name for the male colony of *Volvox aureus.*

Kofoid ('99) gives the following key for the determination of the two species:

Cells about 10,000 (minimum 1,500, maximum 22,000), angular with stout connecting protoplasmic processes into which the chromatophore may enter. Diameter of colony about 700 μ (minimum 400, maximum 1,200); diameter of cell body 3–5 μ. *V. globator* L.

Cells 500–1000 (minimum 200, maximum 4,400); rounded, with slender connecting protoplasmic processes into which the chromatophore does not enter. Diameter of colony 170–180 μ; diameter of cell body 5–80 μ. *Volvox aureus* Ehrenb.

Klein ('99) gives illustrations of the general appearance of the two species, including reproductive stages. Meyer ('96) gives details of cell structure, with illustrations.

Volvox globator is probably a better form for laboratory work than *V. aureus,* and can be obtained in greater abundance if secured early in the spring. Hence if Volvox is to be studied in the fall by large classes it is well to preserve this species in 4% formalin in the spring; for many purposes the preserved material, if not kept too long, is as good as the living. The study of preserved specimens of *V. globator* can then be supplemented by the living *V. aureus.*

Keeping Volvox alive in the Laboratory.— Terry (:06) in experimenting on the galvanotropism of Volvox met with the usual difficulty in keeping it alive in the laboratory, and concluded that the organisms died of insufficient nourishment caused by improper food supply and poor light, but found it impossible to regulate either so that they would live for more than four days. My own experience has convinced me that in our laboratory one of the principal causes of the death of the organism has been injurious mineral substances in the tap water in which the specimens were kept.

In collecting Volvox for our laboratory it has been customary to bring in considerable quantities of vegetable material (duckweed, Riccia, etc.) from the ponds in which Volvox occurred, along with a little water, and place this material in shallow glass dishes filled with tap water. As fast as the organisms gathered on the lighted side of the dish they were picked off and removed to a dish of clean tap water, it being deemed unsafe to leave them in the original dish exposed to the attacks of crustaceans. Suspecting that deleterious substances in the tap water, as well as the lack of a proper food supply, caused the death of the organisms, I made an attempt to reproduce the natural conditions. Water containing Volvox was brought in in considerable quantities, together with a small amount of the vegetable material, and placed in shallow glass dishes without the addition of tap water. The dishes were placed near windows and covered with glass plates to prevent loss of water by evaporation and to keep out bacteria and fungi, except that when exposed to direct sunlight it was found advisable to leave room for circulation of air between the cover and the dish to prevent a rise of temperature beyond the optimum. The water was not changed at any time during the course of the experiment. In the majority of the aquaria thus prepared, Volvox flourished for several weeks; in the fall of 1905, *Volvox aureus* was kept alive in several aquaria for from four to eight weeks; less success was attained with *Volvox globator* in the spring, but it was kept alive in most cases for about two weeks.

It was noted that *Volvox globator* clusters about decaying insect larvæ, perhaps on account of the presence of carbon dioxide. A moderate amount of decaying plant or animal material in the water seems to be one of the essential conditions for its existence. In its natural environment, Volvox is often found in decidedly stagnant water.

Temperature is an important factor to be considered in caring for Volvox. It is more difficult to keep the material alive in the laboratory during warm weather because, in exposing the dishes to sunlight, the water is likely to become warmer than that of the ponds in which Volvox lives. This difficulty might be overcome by placing the dishes where they will be partly immersed in the running water of a shallow aquarium, and at the same time receive an abundance of sunlight.

In case organisms that feed upon Volvox are too abundant, the latter may be freed from its enemies by removing it with a pipette when clustered at the lighted side of the dish, to a dish of pond water strained through bolting cloth to remove crustaceans, etc.

Obtaining Volvox in the Sexual Stage.— Both in the fall and in the spring, material in the sexual stage was obtained in abundance merely by keeping the organisms alive in the laboratory. Several aquaria should be set up, and in some of them, specimens in the sexual stage will usually be found in the course of one or two weeks. It was noted by Dr. H. H. Newman that they often remain hidden in the ooze at the bottom of the dish. When they reach the sexual stage they seem to become less motile and consequently drop to the bottom. This is especially true of sperm colonies in *V. aureus.*

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LITERATURE

Klein, L.
'99. Morphologische und biologische Studien über die Gattung Volvox. *Jahrb. f. wiss. Bot.*, vol. 20.

Kofoid, C. A.
'99. Plankton Studies, etc. *Bull. Ill. State Lab. Nat. Hist.*, vol. 5.

Meyer, Arthur.
'96. Die Plasmaverbindungen und die Membranen von *Volvox globator, aureus,* und *tertius,* mit Rücksicht auf die thierischen Zellen. *Bot. Zeit.* vol. 54, pp. 187–217.

Terry, O. P.
:06. Galvanotropism in Volvox. *Am. Journ. Physiol.*, vol. 15, No. 3.